

CLAIMS

1. A process of forming a material with at least two regions of differing refractive indices comprising the steps of:

5

- (a) providing an amount of a gelable composition comprising at least one gelable component in a desired form;
- (b) exposing the gelable composition to conditions which partially gel the gelable composition so that an amount of ungelled material remains;
- 10 (c) exposing at least one discrete region of the partially gelled product of step (b) to conditions which induce more complete gelation of the partially gelled gelable composition so that more of the ungelled material is incorporated into the gel structure in said at least one exposed region than in non-exposed regions; and
- 15 (d) removing material not incorporated in the gel structure at least from the non-exposed regions to create a refractive index difference between the material of said at least one exposed region and the material of the non-exposed regions.

20

2. A process according to claim 1 wherein a second component is provided together with the gelable component, the second component being selected to impart a higher or lower refractive index to that part of the material in which it is incorporated.

25

3. A process according to claim 1 wherein the material is provided with a step in refractive index between at least two regions of the material.

4. A process according to claim 2 wherein an amount of second component not bound in the material is extracted by step (d).

30

5. A process according to claim 1 wherein an amount of ungelled gelable component is extracted by solvent.

6. A process according to claim 2 wherein an amount of second component is extracted by solvent.
7. A process according to claim 1 wherein the gelable component is selected from those which are susceptible to cross-linking.
8. A process according to claim 7 wherein after step (c) has been carried out the discrete region(s) exposed to the conditions have cross-linked to a greater extent.
9. A process according to claim 1 wherein the gelable composition is gelable by at least one of the methods selected from the group consisting of:
irradiation, exposure to elevated temperatures or by exposure to electron or ion beams.
10. A process according to claim 1 wherein a mask is used to expose at least one discrete region of the product of step (b) to conditions which induce more complete gelation of the partially gelled gelable composition.
11. A process according to claim 1 wherein the gelable composition is gelable by UV irradiation.
12. A process according to claim 1 wherein the polymerisable component is selected from alkyl or acyl substituted alkoxysilanes including:
(3-glycidoxypropyl) trimethoxysilane;
(3-glycidoxypropyl) triethoxysilane;
(3-glycidoxypropyl) methyldimethoxysilane;
(3-glycidoxypropyl) methyldiethoxysilane;
(3-glycidoxypropyl) dimethylmethoxysilane;
(3-glycidoxypropyl) dimethylethoxysilane;
2-(3,4-epoxycyclohexyl) ethyltriethoxysilane;
2-(3,4-epoxycyclohexyl) ethyltrimethoxysilane;

epoxypropoxypropyl terminated polydimethylsiloxanes such as epoxycyclohexylethyl;
methylsiloxane-dimethylsiloxane copolymers;
methacryloxypropyltrimethoxysilane;
methacryloxypropyltriethoxysilane;
5 methacryloxypropylmethyldimethoxysilane;
methacryloxypropylmethyldiethoxysilane;
methacryloxymethyltrimethoxysilane;
methacryloxymethyltriethoxysilane;

- 10 2-hydroxy ethyl methacrylate;
2-hydroxy 3-methacryloxy propyl methacrylate;
3-hydroxy propyl methacrylate;
tetrahydro furfuryl methacrylate;
zirconium tetramethacrylate;
15 acryloxypropyltrimethoxysilane;
acryloxypropylmethyldimethoxysilane;
2-hydroxy ethyl acrylate;
3-hydroxy propyl acrylate;
2-hydroxy 3-methacryloxy propyl acrylate;
20 2-hydroxy 3-acryloxy propyl acrylate;
diethylene glycol diacrylate;
triethylene glycol diacrylate;
tetraethylene glycol diacrylate;
trimethylol propane triacrylate;
25 1-6-hexanediol diacrylate.

13. A process according to claim 2 wherein the exposed region(s) has a greater amount
of second component bound in the gel and has a higher refractive index than the non-
exposed region(s) with lesser amounts of the second component bound in the gel, at a
30 desired wavelength.

14. A process according to claim 2 wherein the second component comprises solid particles.

15. A process according to claim 14 wherein the second component is provided as a dispersion in the gelable component.

16. A process according to claim 2 wherein the second component is capable of being bound in the gel structure.

17. A process according to claim 2 wherein the second component is selected from alkyl or acyl substituted alkoxy silanes including:

diphenyldimethoxysilane;

diphenyldiethoxysilane;

diphenyldipropoxysilane;

dimethyldimethoxysilane;

dimethyldiethoxysilane;

dimethyldipropoxysilane;

methylphenyldimethoxysilane;

methylphenyldiethoxysilane;

methylphenyldipropoxysilane;

tetramethoxysilane;

tetraethoxysilane;

tetrapropoxysilane;

phenyltrimethoxysilane;

phenyltriethoxysilane;

phenyltripropoxysilane;

methyltrimethoxysilane;

methyltriethoxysilane;

methyltripropoxysilane.

18. A process according to claim 1 wherein the refractive index of the exposed region(s) and the non-exposed region(s) is in the range of about 1 to about 6 such as from about 1.3 to about 3.

5 19. A process according to claim 1 wherein the difference in the refractive index of the exposed regions(s) and the non-exposed regions is in the range from about 0.001 to about 0.5.

10 20. A process for forming a material with a least two regions of differing refractive indices comprising the steps of:

- (i) forming a buffer layer on a desired substrate;
- (ii) applying a gelable composition comprising a gelable component to the buffer layer so that the gelable composition is in a desired form;
- (iii) exposing the gelable composition to conditions which partially gel the
- 15 gelable composition so that an amount of ungelled material remains;
- (iv) exposing at least one discrete area of the partially gelled product of step (iii) to conditions which induce more complete gelation of the partially gelled gelable composition so that more ungelled material is incorporated into the gel structure in said at least one exposed region than in the non-exposed regions; and
- 20 (v) extracting material not incorporated into the gel structure at least from that region not exposed to the conditions of step (iv) to create a refractive index difference between the material of said at least one exposed region and the material of the non-exposed regions.

25 21. A process according to claim 1 comprising the additional step of providing a protective layer or coating for the material.

22. A material with at least two regions of differing refractive indices obtainable by a process according to claim 1 or claim 20.

30

spec0903